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Study of space-time variations of local gravity field for the MIGA antenna and for future low frequency GW detectors

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Fluctuations of the earth gravity field can impact ultra precise experiments investigating general relativity such as gravitational waves detectors. Indeed, such experiments monitor distance between free falling test masses, which positions are affected by local gravity changes. These gravity fluctuations may come from density variations around the antenna, linked to local seismic or atmospheric perturbations. These effects will be studied by MIGA (Matter-wave laser Interferometer Gravitational Antenna), demonstrator for a future generation of low frequency GW detector based on atom interferometry that is now under construction at the low noise underground laboratory LSBB in France. MIGA will provide precise measurements of gravitational strain variations induced between free falling atom sources distant by up to 200 m. Using seismic and atmospheric data gathered on-site, we project the gravity gradient noise (GGN) expected to be introduced on future MIGA measurements by these two contributions. By studying the spatial correlations expected for those noises, we also present advanced GW detectors geometries based on networks of Atom Interferometers providing an important GGN reduction.